Shenandoah Salamander Monitoring Protocol

Introduction

Although many animals in Shenandoah are easily observed, some of the most common are cryptic and well hidden from even the most inquisitive eyes. One such group of animals are the salamanders. These small amphibians make a living under leaves, stones, and downed wood in both aquatic and terrestrial environments. Salamanders can be extraordinarily important to forest and headwater ecosystems, simply because many species are so abundant. For instance, previous work has shown that in forests of the southern Appalachians, the biomass (or weight) of salamanders per acre can be greater than all other vertebrates combined (Hairston, 1987).

Photo by J. Sevin, Smithsonian Institution

Management Needs

Salamanders are a diverse group of animals, and the Appalachian Mountains provide a "hotspot" of this diversity, containing nearly 15% of the world's species. Although many of these species are widespread and abundant, some are extremely rare and are found in very few locations. One such rare species is the Shenandoah salamander (Plethodon shenandoah). This animal is only found in Shenandoah National Park and is listed as a federal and state endangered species. Once believed to be more widely distributed, the Shenandoah salamander can now be found in small populations at the higher elevations of Pinnacles, Stony Man and Hawksbill Mountains. This unique salamander lives on these mountaintops, under rocks and debris for most of the year, only venturing out onto the forest floor during moist nights to feed on small insects and other invertebrates.

Most of what we know about the Shenandoah salamander was learned by herpetologist Bob Jaeger in the 1970s and park volunteers Bill Witt and Lester Via in the late 1980s and early1990s. The species was listed as federally endangered in 1988 and, in 1994, the U.S. Fish and Wildlife Service published the species Recovery Plan which outlined multiple tasks to address the study and management of this endangered species (http://ecos.fws.gov/docs/recovery_plan/940929a.pdf).

Following the initial work in the 1970s and 80s, little additional information had been collected about the Shenandoah salamander until 2007, when multiple government agencies, including the National Park Service, US Geological Survey, Smithsonian Institution, US Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries (VDGIF), joined together and dedicated funds and in-kind services to conduct new research. This research is not only leading to a greater understanding of a species we know little about, but the development of a long-term monitoring and management plan.

Eventually, this monitoring will join the suite of Vital Signs that park staff members currently monitor.

Photo by J. Sevin, Smithsonian Institution

Current Procedures

The current research is focusing on factors affecting the distribution of the Shenandoah salamander, including habitat use, competition, and dispersal. In 2007, a pilot study was initiated to investigate the optimal survey method for this species. Salamanders can be difficult to accurately sample in the field, and data were needed to assist researchers and managers in determining how and when to sample for Shenandoah salamanders. This information is used to obtain the best probability of detection during surveys and to understand the variability in the probability of a particular site being occupied by salamanders. We can now better address the size and shape of the needed sampling area, the time of day and season to sample, under what environmental conditions to sample, and the number of sites and repeated visits needed to address a variety of studies or monitoring goals. Genetic studies using tail tips were also undertaken to confirm the ability of researchers to properly distinguish the identification of the Shenandoah salamander from its close relative and potential competitor, the red-backed salamander (Plethodon cinereus).

What We Have Learned

While this is an ongoing study and much data still needs to be analyzed, new information has already been acquired. Results to date indicate that Shenandoah salamanders still occupy much of

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their historic range. In addition, a small number of new sites within the area of potential habitat (mostly those on the periphery of historic habitat) have been documented to be occupied by Shenandoah salamanders. In contrast, some sites that used to be occupied by Shenandoah salamanders now appear to be exclusively occupied by red-backed salamanders. 20 percent of the sites searched were occupied by both Shenandoah salamanders and red-backed salamanders during at least one season. The most remarkable findings to date have been on the life history of this animal. In 2008, the first documented nest site for Shenandoah salamanders was discovered in the wild (see picture) and pregnant females have been found in both the spring and fall seasons.

References

Hairston, N.G. 1987. Community ecology and salamander guilds. Cambridge University Press, New York.